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THE LIFE AND WORK OF AMOS PEASLEE BROWN

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Washington, D. C.

A FEW months ago a brief note announced to our readers the passing away of Professor Amos P. Brown, of the University of Pennsylvania. It is fitting that a page or two be devoted here to a sketch of his life and scientific career. He was born in Germantown, Philadelphia, on December 3, 1864, studied at the University of Pennsylvania, and received the degrees of Bachelor of Science in 1886 and Mining Engineer in 1887. During the following two years he was assistant on the Second Geological Survey of Pennsylvania, and in 1889 became instructor in mining and metallurgy at his alma mater. Pursuing postgraduate studies in chemistry and mineralogy, he received the degree of Doctor of Philosophy in 1893, his thesis being on the chemical constitution of pyrite and marcasite. In 1895 he became assistant professor of mineralogy and geology in the college department, a few years later professor in the auxiliary department of medicine, and in 1898 head professor of the department of mineralogy and geology, which position he held until forced to resign by ill health in the spring of 1917. A breakdown from overwork and worry in connection with the monumental research on the crystallography of the hemoglobins, together with liver and intestinal trouble which necessitated a couple of operations, forced him to take long vacations from his college work during the last few years of his life, but he never fully recuperated, and after gradually failing for some months he died on October 9, 1917.

It was the writer's good fortune to receive instruction in mineralogy and related subjects from Professor Brown over a period of six years, 1903–09, and a few personal recollections may be acceptable here. He spoke rather slowly, in a low tone of voice, and sometimes failed to impress the undergraduate students. In postgraduate work, however, where he could address a limited number of men deeply interested in the subject, he was a splendid teacher, for he was widely read in all fields of his chosen subject, as well as in various other branches of natural science, and possessed exceptional ability in sizing up the value of a contribution, extracting from it what was new and important, and presenting it in an instructive, interesting, and inspiring way. I recall how lucidly he discussed isomorphism, the field in which he was later to make his greatest contribution to science, and pointed out what must be its significance in connection with molecular structure (which has since been found to be substantially correct by x-ray studies). He was very familiar with the geology of the region around Philadelphia, and felt strongly that such maps as had been published, while they might be correct in many details, were lacking in breadth of interpretation of the interrelations between the various formations.

Professor Brown's contributions to science were not numerous nor with one exception of great importance. His thesis for the doctor's degree, above mentioned, represented real pioneer work in the study of mineral constitution, altho the conclusions drawn are now known to have been unjustified, owing to misinterpretation of the influence of some of the constituents of the minerals and solutions. The text-book used in his classes, "Mineralogy Simplified," was almost entirely his own work, altho, being based originally on another book with the same title, its authorship was credited to "Erni and Brown." He started a compilation of the economic minerals of Pennsylvania, but being forced by ill health to give it up, it was completed by his assistant, Dr. Frederick Ehrenfeld; and as simultaneously the latter had to take over the presentation of most of Dr. Brown's lectures in the department, he was unable to prepare as complete or accurate a work as might have been desirable by the time the Topographic and Geologic Survey Commission of the State was ready to proceed with its publication.

The work for which Professor Brown will be longest remembered and admired was that on the crystallography of the hemoglobins, a huge quarto volume published by the Carnegie Institution, of which Dr. E. T. Reichert, of the medical department of the University of Pennsylvania, was a joint author, contributing the biological matter included. Crystallized hemoglobin derivatives were prepared from the blood of a number of different animals, and studied under the "petrographic" microscope, determinations being made of the interfacial angles, and from them the systems and axial ratios of the substances, as well as of optical properties in many cases. The measurement of thousands of angles in this way was in itself a formidable undertaking; but the greatest achievement was the interpretation of the observations. Professor Brown was able to recognize almost intuitively the presence of isomorphous relations between crystals showing no very apparent points of similarity, and demonstrated that the greater the degree of isomorphism the closer were the animals yielding the crystals related. His success in carrying out the microscopic measurements was all the more remarkable in that he was personally acquainted with but few modern petrographers, and gained his knowledge of the methods almost entirely from the literature and from practice by himself. His ability to recognize obscure isomorphous relations was also an indication of how thoroly and discriminatingly he had made use of published information in this difficult field of study.

Always quiet, reserved, and shrinking from publicity, Professor Brown was not as widely known, nor his ability as fully appreciated, as should have been the case. But from the above brief account of his life and work it will be seen that his death is indeed a loss from the all too limited group of American mineralogists.

SOME MINERALS FROM THE STANLEY ANTIMONY MINE, IDAHO

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National Army

The Stanley Mine is located in Gorge Gulch, about one fourth mile from Burke, in the Coeur d'Alene District, Idaho. The vein is unique in that its valuable constituents are antimony and gold, altho it is located in the center of an area characterized by the presence of lead-silver deposits. The vein is lens-like in its character, being exceedingly variable in width and metallic content. The filling of the vein is milky-white quartz, but this gives out in places, the full width of the vein being then pure stibnite. The inclosing rocks are greenish, sericitic slates of the Burke formation, a member of the Algonkian series of sediments known as the Belt Terrane. The mine first began shipments of gold-antimony ore to Granite City, Illinois, in 1906 and maintained a considerable production for some time. The ore was sorted by hand, on the dump, into three products—first-class or shipping ore, consisting of practically pure stibnite; second-class, consisting of scattered small grains of stibnite in quartz; and waste, or the stibnite-free quartz of the gangue. The "second-class" or milling ore was later hauled to the gold mill of the New Jersey Mine near Kellogg and milled. A large part of the gold content was extracted by simple amalgamation and the stibnite was concentrated on Wilfley tables. The mine was later closed but not apparently from lack of ore, as some ten tons of pure stibnite were left for many years in a pile on the dump. Early in 1915, under the stimulus of the then prevailing price of antimony, the mine was reopened and several carloads of hand-sorted stibnite were shipped. The writer while visiting the mine in September of that year was not allowed inside the workings, but had to be content with an inspection of the dumps and ore heaps. The specimens collected at that time form the basis for the following notes.

Stibnite.—The sulfide of antimony, stibnite, Sb_2S_3, forms the principal valuable constituent of the Stanley ores. It is common in large masses of exceptional purity and also scattered in irregular grains and needles thru the white quartz of the gangue. The large masses have a coarse-columnar structure and often show cleavage blades three inches in length. The mineral does not, so far as seen, occur in free crystals of any size and is of no especial mineralogic interest.

Sphalerite.—The sulfide of zinc is a constant tho inconspicuous constituent of the vein. It occurs in minute, scattered, crystalline grains of a honey-yellow or light brown color.

Gold.—Gold is present in the stibnite to the average value of about $20 per ton. It is rarely visible to the naked eye. One of the ore-sorters showed the writer a specimen of stibnite having small rifts coated with a thin, frost-like film of native gold, the gold evidently being later than the stibnite.

Pyrite.—The disulfide of iron, FeS_2, is very rare in the vein itself but is abundant in the slaty rocks of the walls, immediately adjacent to the vein. It always occurs in minute brilliant striated and very perfect cubic crystals which seldom exceed one sixteenth inch on an edge.

Arsenopyrite.—The sulfarsenide of iron, $FeS_2.FeAs_2$, is, like pyrite, a common mineral in the walls of the Stanley vein but does not occur in the filling of the vein proper. It occurs always as perfect and well-defined crystals of a gray to iron-black color and rather dull metallic luster. The crystals, which are evidently replacements of the sericitic rock in which they occur, are slightly larger than those of pyrite in the same specimen and reach an extreme size of one fourth inch. The dark gray color is not a tarnish, as the crystals show the same color on fresh fracture. Penetration twins and sometimes trillings occur. The crystals are easily detached from the matrix but are not well suited for measurement on the reflecting goniometer as all of the faces are deeply striated. The common aspect is like Figs. 1 and 2, the forms recognized being m(110), n(012) and $\phi(023)$. Both the

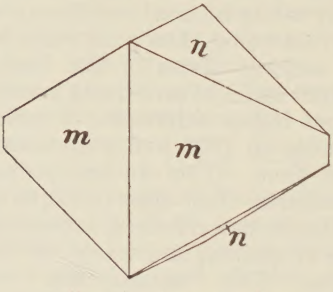

FIG. 1. Arsenopyrite.

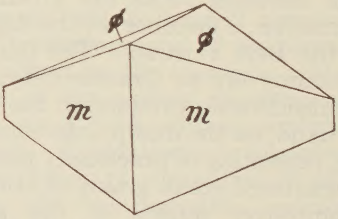

FIG. 2. Arsenopyrite.

pyrite and arsenopyrite appear to have been deposited before the quartz and stibnite of the vein; fragments of the wall rock included in the quartz of the vein contain these minerals.

Kermesite.—The red monoclinic oxysulfide of antimony, $2Sb_2S_3.Sb_2O_3$, occurs as an oxidation product of stibnite in the richest ores, in the form of a blood-red to maroon powder thinly coating cracks in the stibnite. There was not enough of the material for an analysis but the mineral was identified by its color and characteristic blowpipe reactions. No crystals were observed. The mineral is mentioned by Dana[1] from Quebec and New Brunswick but not from any locality in the United States. Eakle[2] reports cherry-red needles from the Mojave antimony mine, 15 miles north of Mojave, Kern Co., California.

Valentinite.—This mineral, which is an orthorhombic trioxide of antimony, Sb_2O_3, is common in the Stanley ores as coatings on stibnite and on quartz. In color the mineral ranges from pale green to buff, the luster being somewhat waxy. The greenish to brown waxy coatings look very much like cerargyrite or embolite. The buff variety is common both on quartz and on stibnite but the green variety was noted only on the latter. The crusts of valentinite consist of drusy crystals of simple form. These are of small size and have rather dull faces and rounded edges which render them unsuitable for measurement on the reflecting goniometer. One specimen contained rather large clean-cut crystals having the form shown in Fig. 3. The *a* and *c* axes are interchanged in the drawing in order to give a clearer idea of the proportions of the crystals. The forms present are m(110) and i(054). The crusts rarely are more than 1 16″ in thickness, but surfaces several inches square may be coated with valentinite crystals up to 1/10 inch in length. This mineral, like the preceding one, is apparently rare in the United States.

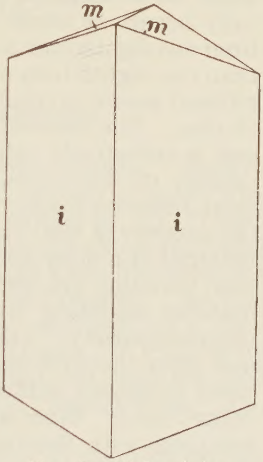

FIG. 3. Valentinite.

Cervantite.—Antimony ocher, $Sb_2O_3.Sb_2O_5$. Occurs commonly as thin, canary-yellow coatings on stibnite. The cervantite seems to be a transitory stage and hydrates easily to the white, hydrous oxide described below. Cervantite is easily distinguished from the other minerals of the ore by its color and by the fact that it yields no water in the closed tube.

"*Stibioferrite.*"—In small cavities in the quartz from the uppermost tunnel of the Stanley Mine, there are thin coatings of a yellow, brownish-yellow or green mineral. This mineral is soluble in hydrochloric acid and the solution reacts for antimony and iron. Some water is given off in the closed tube. The substance thus resembles stibioferrite, a name proposed by Goldsmith for a coating on stibnite from Santa Clara Co., Cal.

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[1] Dana, E. S., System of Mineralogy, p. 107.

[2] Eakle, A. S., Minerals of Calif., *Bull. Cal. State Min. Bureau*, No. 67, p. 43.

Volgerite.—During the visit to the Stanley property, it was noted that many of the lumps of stibnite had an outer crust, composed of a soft, earthy material of dirty white color. This material was abundant at the mine, but some preliminary blowpipe trials gave no distinctive reactions and the mineral looked so much like finely triturated quartzite that it was thought to be only a hardened phase of the gouge which accompanies the vein, and only a small fragment was preserved, accidentally included in the box with the other specimens from the locality. Subsequent study of this fragment showed that the material is a hydrous oxide of antimony containing more than twice as much water as is assigned to stibiconite. The mineral characteristically occurs as shells around the stibnite, the coatings varying from one eighth inch to two inches in thickness. Coatings thinner than one eighth inch usually consist of cervantite, and the whitish mineral seems to result from the further oxidation and hydration of this. The mineral agrees in some particulars with volgerite and is tentatively referred to this species. The material of the interior of the crusts is compact, somewhat translucent, has a faint resinous luster, and a pale grayish-brown color. Toward the exterior of the crust this grades into lusterless, friable earthy material of a dirty white color. So far as could be learned, these two varieties are composed of the same substance, the friable material resulting from the mechanical disintegration of the compact variety. Only a small portion was available for analysis and after the iron and water had been determined, the precipitated antimony sulfide was accidentally lost, without its weight being found. Since an analysis of an antimony oxide is scarcely complete with determinations of neither antimony nor oxygen, the investigation was put aside until more material could be obtained. The additional material has not been forthcoming, however, and since the writer will probably be unable to revisit the locality, these notes are recorded for the benefit of those who may have obtained specimens of the same mineral from this or other localities.

The hardness of the mineral is probably about 3.5 as it scratches calcite easily but does not scratch fluorite. The specific gravity, determined on approximately 0.6 g. of selected small fragments, is 3.082 at 20° C. The mineral contains 12.6% of water, and 1.4% Fe_2O_3. It is completely soluble in hot concentrated hydrochloric acid. After the iron and antimony were removed from the solution, it was carefully tested and no other elements were found. The mineral is evidently a hydrous oxide of antimony, pure except for the presence of a small amount of iron. The powder is dirty brownish to greenish-white. All of the water is given off below a red heat, the powder when dehydrated becoming snowy-white. Slightly above a red heat some oxygen is given off, the higher oxide, Sb_2O_5, apparently passing into Sb_2O_4.

The name volgerite was given by Dana to the compound $Sb_2O_5.5H_2O$, described by Volger, the so-called cumengite, $Sb_2O_5.4H_2O$, being included. The water content of the mineral described above is too low to conform with either formula. Such colloid minerals vary widely in water content, however, and until the composition is more definitely established, the mineral may best be referred to as volgerite.

FAMOUS MINERAL LOCALITIES. 3. AMELIA COURT HOUSE, VIRGINIA

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Academy of Natural Sciences of Philadelphia

SLOWLY our train moved northward towards Virginia. Back of us, in North Carolina, we left a graveyard of fond illusions concerning mineral collectors' paradises, as described by Mr. Trudell last month. As night came on we curled up on the seats, using our blanket rolls as pillows. Of Salisbury and Danville memories remain of waits in cold gloomy train sheds and stations. At 6.35 the next morning (July 27, 1917) we were awakened by a dark voice crying "'Melia, 'Melia, all out for Amelia." Picking up our knapsacks, we lurched to the door, and out into the cool morning air of a typical quiet and peaceful Virginia town. Dr. Wherry joined us a couple of hours later.

Amelia is on the Southern Railway about 35 miles southwest of Richmond, which is 117 miles south of Washington, D. C., from which it may be reached by the Richmond, Fredericksburg and Potomac Railroad. Another route is that from Baltimore, on the York River Steamship Line down the Chesapeake, boats leaving Baltimore and Richmond in each direction, 6 A. M. and 6 P. M. daily except Sunday. It will probably be found necessary to spend a day or a night at Richmond, as there is not even a pretense of connections between the trains on different railroads; and the collector planning a trip to this locality alone should allow about three days.

Amelia, or as called in former days, Amelia Court House, is familiar to everyone who has examined a mineral collection assembled twenty-five or thirty years ago as the locality of brilliant green cleavable amazon-stone, glassy white crystalline albite, and resinous rounded cubic crystals of microlite. It is also known as the locality of many rare-metal minerals, the species hatchettolite being found only there, while the microlite above mentioned, the name of which refers to the minute size of its crystals (a character shown by other occurrences), was obtained at Amelia Court House by the pound.[1]

The old mica and feldspar mines lie north and northeast of the town, but only one of them ever yielded any noteworthy minerals. This is now owned by Mr. A. H. Rutherfoord, who had kindly extended to Dr. Wherry permission to visit the locality and collect specimens. It can be most easily reached by walking northeast up the railroad to a private road, just beyond a grist mill, running north to Mr. Rutherfoord's house. From the house continue across the fields, past a pond, and thru a patch of woods, to a tiny stream on the bank of which the mine is situated. Tho the mine has been abandoned for some time, specimens are abundant in the dumps, and intensive collecting with picks would bring a wealth of good material to light.

Albite in beautiful groups of white tabular crystals is the most conspicuous and abundant mineral; some of it is a good moonstone. Closely associated with it is amazon-stone, and lamellar calcite (argentine). The albite is the matrix of the following rare-metal minerals: microlite (we obtained a rough one-inch crystal), columbite, manganotantalite, monazite, cyrtolite, and cassiterite. Other minerals found were milky quartz, beryl, muscovite and leverrierite. Traces of spessartite and chlorophane were noted, but these are now very rare.

We worked on the dumps the whole afternoon, and then returned to the hotel. A little after six, the ringing of a bell was heard, and we were ushered into a well-appointed dining hall. Each table was furnished with a variety of sauces, a great quantity of hardware on clean white linen; in fact there seemed little room for the quantity of food which would be needed to sustain three hungry rock-breakers. But there was room and to spare for the repast set before us which reminded us of the derivation of the name of the aforesaid microlite. The youngster who waited on us had mahogany-red (Ridgway; 40 per cent. red, 60 per cent. orange) hair and freckles, and wore for the occasion a white starched linen coat, in which he moved noiselessly around the room in his bare feet. He brought each of us a thin slice of bread, two button-size biscuits, a tiny meat cake, one slice each of ham and tomato, and some coffee. We managed to live thru the night by patronizing the soda fountain around the corner.

The next morning we made another trip to the mine to bring back a final load of specimens, which were packed at the station;

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[1] For a list of minerals see Dana's System, p. 1071, and W. M. Fontaine, Notes on the occurrence of certain minerals in Amelia Co., Va., *Am. J. Sci.* [3], 25, 330–339, 1883.

and at noon we took the train for Richmond and Washington, finally returning to Philadelphia Sunday evening, after a most instructive and on the whole enjoyable vacation trip.

PROCEEDINGS OF SOCIETIES

THE PHILADELPHIA MINERALOGICAL SOCIETY

Wagner Free Institute of Science, January 10, 1918

The president, Dr. Leffmann, in the chair. Fourteen members and one visitor present.

Mr. John F. Vanartsdalen presented a paper on The Minerals of the Paper Mills and Jarrett's quarries, Montgomery Co., Pa. The rocks of the quarries, hornblende gneisses of various types, were described and the minerals noted. The lecturer exhibited a large number of specimens from the quarries.

Mr. William Knabe reported the opening of Wood's mine and Low's mine, near Texas, Lancaster Co., Pa., localities famous in the past for brucite, kammererite, and other serpentine minerals.

Samuel G. Gordon, *Secretary*

FIELD TRIP ANNOUNCEMENT

Sunday, April 12; Brinton's quarry, Osborn's Hill, and Strodes Mill, Chester County, Pa. Meet at 69th St. Terminal at 8.15 A.M.

At the anniversary meeting of the Mineralogical Society (London), held on November 6, 1917, the following officers were elected: *President*, Mr. W. Barlow; *Vice-Presidents*, Prof. H. L. Bowman, and Mr. A. Hutchinson; *Treasurer*, Sir William P. Beale, Bart.; *General Secretary*, Dr. G. T. Prior; *Foreign Secretary*, Prof. W. W. Watts; *Editor of the Journal*, Mr. L. J. Spencer. —*Nature*, **100** (2507), 210, 1917.

NOTES AND NEWS

At the meeting of the Geological Society of America in St. Louis, December 27–29, 1917, the following papers of mineralogical interest were presented: Glauconite in dolomite and limestone in Missouri, by W. A. Tarr; Fluorite in the Ordovician limestones of Wisconsin, by R. M. Bagg; and The occurrence of a large tourmaline in Alabama pegmatite, by F. R. Van Horn. The crystal described in the last was originally over 3 feet long and weighed about 250 pounds; the top of it, showing distinct tho rough terminal planes, is now in the Museum of the Case School of Applied Science, Cleveland, Ohio.

The Washington *Star* thus comments on the increasing value of colloidal carbon:

Oh, carbon is a precious thing
  Whose prices we can ne'er control.
Oh, give to me no diamond ring!
  I'd rather have a ton of coal.

Dr. Francis M. Van Tuyl, formerly instructor of geology in the University of Illinois, now assistant professor in the Colorado School of Mines, in Golden, Colo., has enlisted in the aviation corps.

NEW MINERALS

FLOKITE

Flokit, a new zeolite from Iceland. Karen Callisen. *Medd. Dansk Geol. För.*, **5** (9), 1917.

Name: After the Viking, Floki Vilgerdarson, Iceland's third discoverer, who gave the island its name.

Physical Properties

Color: Transparent and colorless, or with a faint gold-greenish hue, sometimes dark colored by inclusions. Luster: vitreous. Form: thin slender prismatic crystals 1–1½ cm. by ½ mm. H. = 5; Sp. Gr. = 2.102.

Crystallographic Properties

Monoclinic. 100:110 = 41° 18′. Forms: (110), (100), (010), faces vertically striated. Sections parallel to (010) show twinning on (100). Cleavage (100) and (010) perfect. Fracture: conchoidal across prism zone.

Optical Properties

Thin sections perpendicular to the prism zone show a division into segments with different optical orientation. In the center the optical axial plane is perpendicular to (010). $b = \gamma$, $c : \alpha =$ about 5°. Optically —. Axial angle large. Acute bisectrix nearly parallel to c axis. $\alpha_{Na} = 1.4720$, $\gamma_{Na} = 1.4736$ $(\gamma - \alpha) = 0.0016$. On warming to 117°–118° the sign changes.

Chemical Properties

Composition: $H_8(Ca,Na_2)Al_2Si_9O_{26}.2H_2O$. Analysis by C. Christensen: SiO_2 67.69, Al_2O_3 12.43, MgO 0.09, CaO 2.65, Na_2O 4.36, $-H_2O$ 4.53, H_2O 8.82, sum 100.57.

B. B. fuses easily with intumescence. Insol. in boiling HCl.

Locality uncertain; the material was found on an old specimen of mesolite in the museum at Copenhagen labeled from "Eskefjord? Iceland"; but a specimen from Teigerhorn showed optically the presence of flokite. S. G. G.

TUNGSTENITE

Tungstenite, a new mineral. R. C. Wells and B. S. Butler, U. S. Geological Survey. *J. Wash. Acad. Sci.*, **7** (20), 596–599, 1917.

Name: Tungstenite from its composition, a tungsten sulfide, and its similarity in formula and some of its properties to molybdenite.

Physical Properties

Color: Dark lead gray. Opaque. Streak: dark gray. Luster: dull to brilliant metallic. H = about 2.5. Sp.Gr. about 7.4.

Chemical Properties

Composition: probably WS_2; not yet found pure.

Unattacked by hydrochloric acid or nitric acid; decomposed by aqua regia or by fusion with sodium nitrate.

Occurrence

In a hydrothermal deposit, a replacement of a brecciated zone in Paleozoic limestone, the Emma mine, Little Cottonwood District, Salt Lake Co., Utah, associated with tennantite, tetrahedrite, pyrite and galena. S. G. G.